High-Speed Penetration Dynamics

Engineering Models and Methods

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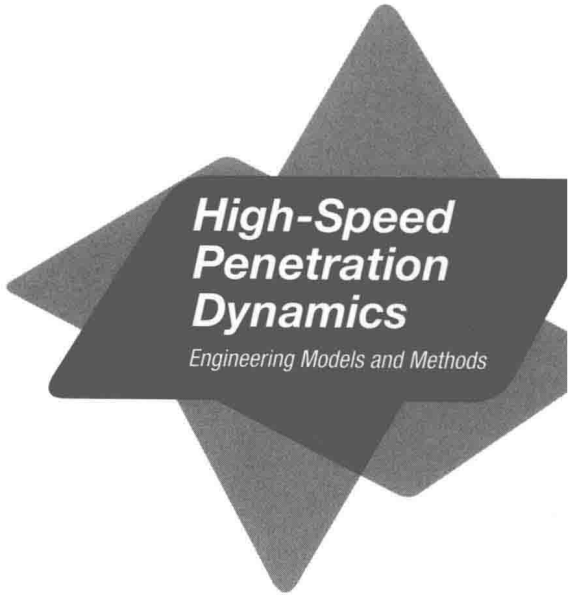
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Preface

The subject of this book is related to the previous monograph by the authors (Ben-Dor et al., 2006a). However, the contents of the book and the amount of included material are completely different.

In this book we consider normal high-velocity penetration (with zero angle of attack) of rigid (non-deformable) projectiles into a shield. High-speed penetration is accompanied mainly by local interaction of a striker with a shield and corresponds to the range of impact velocities from several hundreds up to $1{,}500\, m/s$. The case of relatively small impact velocities when a striker interacts with a whole plate and hypervelocity penetration that can be described by hydrodynamic models, are not considered in the monograph.

In writing the book the authors pursued two goals: (i) to give a comprehensive description of the engineering models for calculating high-speed penetration of rigid projectiles into various media (concrete, metals, geological shields) and (ii) to demonstrate the capabilities and efficiency of using approximate models for investigating conventional and non-standard problems of penetration mechanics.

The first goal is accomplished by surveys which describe empirical (phenomenological) and analytical models of penetration into concrete, metals and geological shields. This part of the book (more than a quarter of the book) is in fact a handbook since it contains a very detailed summary of the models that allows their use for practical calculations.

The second goal is achieved by presenting the results of the investigations which the authors conducted during recent years. Presentation includes comprehensive surveys of the state-of-the art in relevant research fields. The problems considered can be separated into two large classes. The first class includes the traditional problems where a considerable progress has been achieved during the last years: analysis of the effect of spacing and layering on protective properties of plates and optimization of the multilayered shields; optimization of the shape of the projectiles penetrating into various shields; optimization of two-

component ceramic-metal armor. The second class includes nontraditional problems and approaches: modeling of penetration and optimal control of penetrators equipped with jet thruster; investigation of the efficiency and optimization of segmented impactors; new approaches for developing penetration models (inverse problems); estimating ballistic properties of penetrators under the conditions of incomplete information.

Each chapter is accompanied by a list of the notations used repeatedly in this chapter; in addition, generally all notations are explained in the text of the chapter when they are used for the first time. Consequently, the presentation of the material in the book is convenient and allows reading different chapters independently. However, even a cursory examination of Chapters 1 and 2, which present the most widely used universal approaches, is advised for better understanding of some sections.

Unless otherwise indicated SI units are used.

To master the material presented in the monograph, it is sufficient for the reader to be familiar with basic engineering courses in mathematics and mechanics. Nevertheless, if the reader is not interested in the mathematical proofs in the chapters dealing with investigation of applied problems, these proofs can be skipped without impairing an understanding of the obtained results.

The authors believe that this monograph will become a reliable and indispensable reference guide for anyone interested in using engineering models in high-speed penetration mechanics.

The authors are indebted to Mrs.V. Orlov for her help in technical editing of the manuscript and preparation of the camera-ready version.

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